ON ECOHYDROLOGICAL INVESTIGATION OVER THE HIMALAYAS

JAGDISH BAHADUR
Department of Science and Technology, Government of India
Technology Bhawan, New Delhi 110016, India

Calling the Himalayas the tallest water tower of the earth with the inherent characteristics of a natural environment and ecosystem, the need to evolve an appropriate mix of traditional with modern knowledge for rational water utilisation on a sustainable basis is outlined. The utmost cooperation of all concerned is needed to manage water resources with a full understanding of their spatial and temporal vagaries for sound management of the apex environment. The quantum of atmospheric moisture and interrelationship between cryosphere and atmosphere are outlined with regard to heat and water exchange. The role of extensive snow (over a million km^2 in winter) and glacier cover (approximately 100,000km^2 in summer) in moderating, modifying, and modulating the weather and climate of the region is brought out. The percentage of seasonal (June to September) to annual rainfall ranges from 45.9% for Jammu and Kasmir to 90.4% for Nagaland, Manipur, and Mizoram in different Himalayan meteorological subdivisions of India. This is discussed in this paper along with available hydrometeorological observations made at higher altitudes by Chinese investigators. Investigations on snow and glacial meltwater contributions from various Indian workers are given and their findings highlighted. It is estimated that from 400 to 800km^3 flows down the Indus, Ganges, and Brahmaputra river systems every year. Studies of manmade water storage reservoirs higher than 100m, with 51 km^3 capacity at the base of the mountain system, are included, pointing out the need to increase the storage capacity for all round and longer availability of water in the higher mountain region and also to reduce downstream surface runoff and control loss of valuable soil necessary for environmental regeneration.

Case studies dealing with rainfall trends at Barapani for 31 years (1957-87) indicate no change in rainfall; water harvesting in the NE hill region with rain-runoff varying from 30.8 to 85%; runoff duration, from 240 to 1,293 hours; soil losses were from 3.62 to 22.5t/ha. The soil-water conservation measures

for increased agricultural production, temporal variation of rainfall which decreased by 120 to 206mm during last 100 years, and temperature rises at three locations in the Ganges basin are presented and discussed. Scenarios from various global climatic models upto 2100 A.D. and observations on CO_2 concentration are also incorporated for climatic change studies. The need for improved understanding of the ecohydrology of the Himalayan system, based on weather and climate, is emphasised. It is suggested that coordinated and planned land-surface atmospheric experiments should be conducted with the establishment of mesoscale and long-term flux measurements at selected sites, combined with hydrological and vegetation studies to provide meaningful inputs for developmental strategies. This needs local, regional, and international cooperation, adopting an inter-institutional and multidisciplinary approach for the highest mountain system in the world.